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# Design, characterization and modelling of high efficient solar powered lighting systems

Peter Nymann<sup>a</sup>, Frederik Svane<sup>a</sup>, Peter Behrendorff Poulsen<sup>\*,a</sup>, Sune Thorsteinsson<sup>a</sup>, Johannes Lindén<sup>a</sup>, Rasmus Overgaard Ploug<sup>a</sup>, Anders Thorseth<sup>a</sup>, Maria C. Mira<sup>b</sup>, Arnold Knott<sup>b</sup>, Ib Mogensen<sup>c</sup>, Kris Retoft<sup>c</sup>

<sup>a</sup> Department of Photonics Engineering, Technical University of Denmark, Frederiksborgvej 399, Building 130, 4000 Roskilde, Denmark

<sup>b</sup> Department of Electrical Engineering, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark

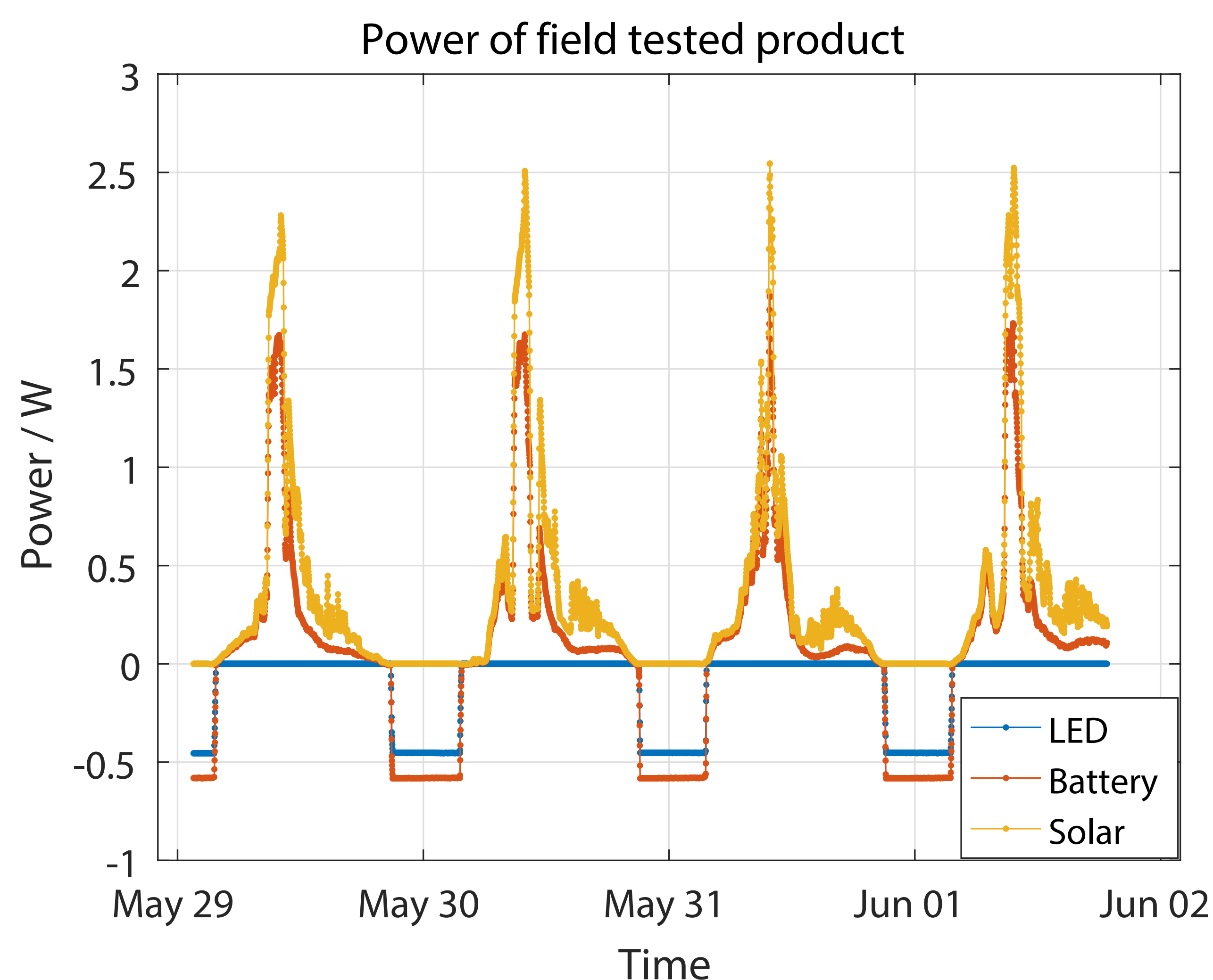
<sup>c</sup> Outsider, 2300 Copenhagen S, Denmark

\* Contact: Phone +45 21325110; E-mail: ppou@fotonik.dtu.dk

## Motivation

Urban solar powered standalone lighting systems have become progressively more popular due to increasing efficiency and decreasing costs of PV-panels. In order to leverage the technology, to its fullest with minimal costs, it is necessary to determine the dimensions of the system components before development. However no tool yet is able to simulate an entire standalone system for component dimensioning. An attempt of such a tool is here validated against a field test.

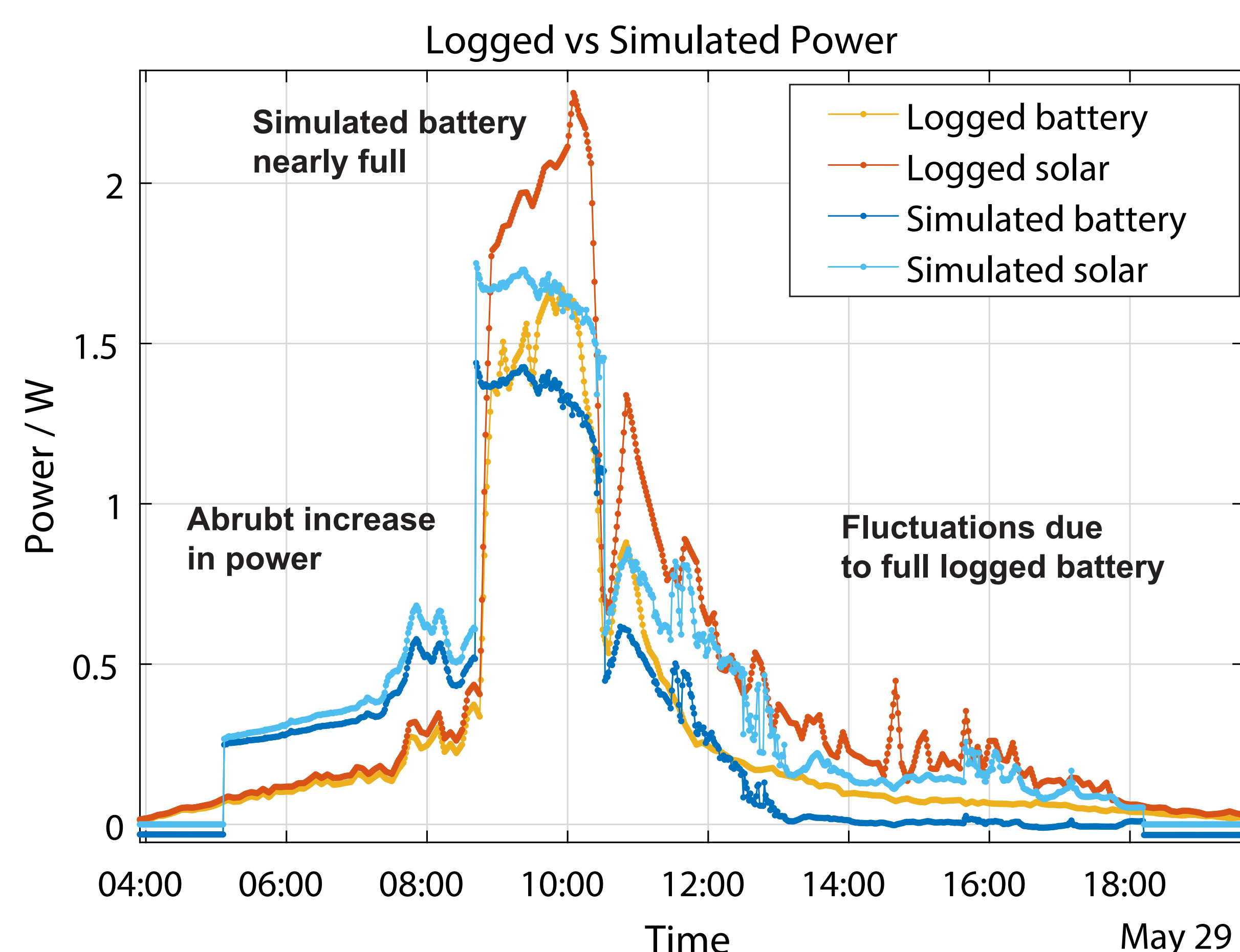
## Fieldtest



Power measurement from the field test. Device from the living lab at DTU Risø

A living lab and a specialized laboratory is installed. One to feed the simulation tool with characterisation data of the different component. The other to monitor the field test product.

## Validation



1. The cumulated energy flow over the four days for the PV, battery and LED is respectively 29.4 Wh, 3.1 Wh, and 12.0 Wh. Simulated differences 2.9 %, 4.5 % and 5.3 %.

2. Better panel characterisation, Abrupt increase in power, and higher power during early hours of day

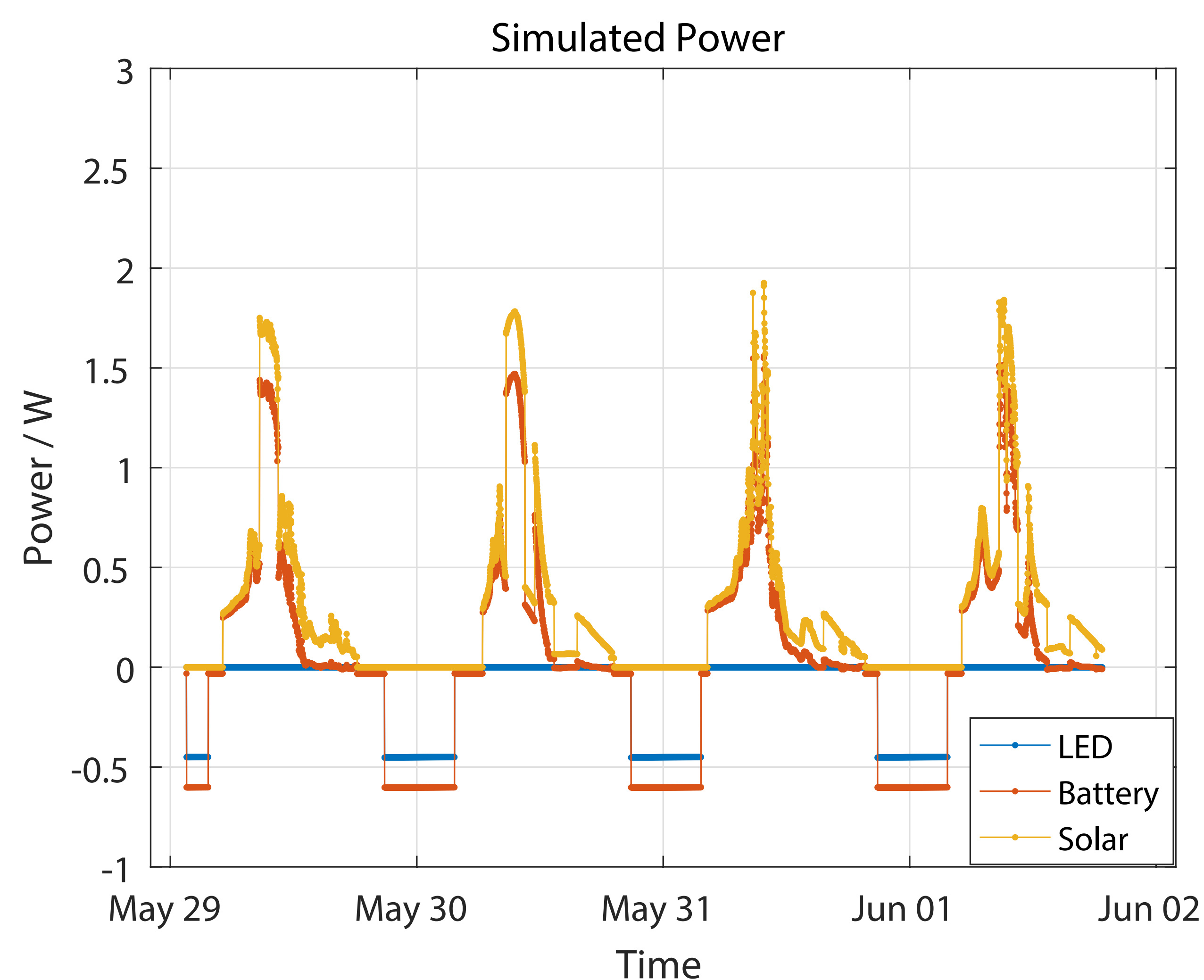
3. Better battery characterisation, Simulated battery is charged faster than logged battery

Simulated model lacks current fluctuations for nearly charged battery.

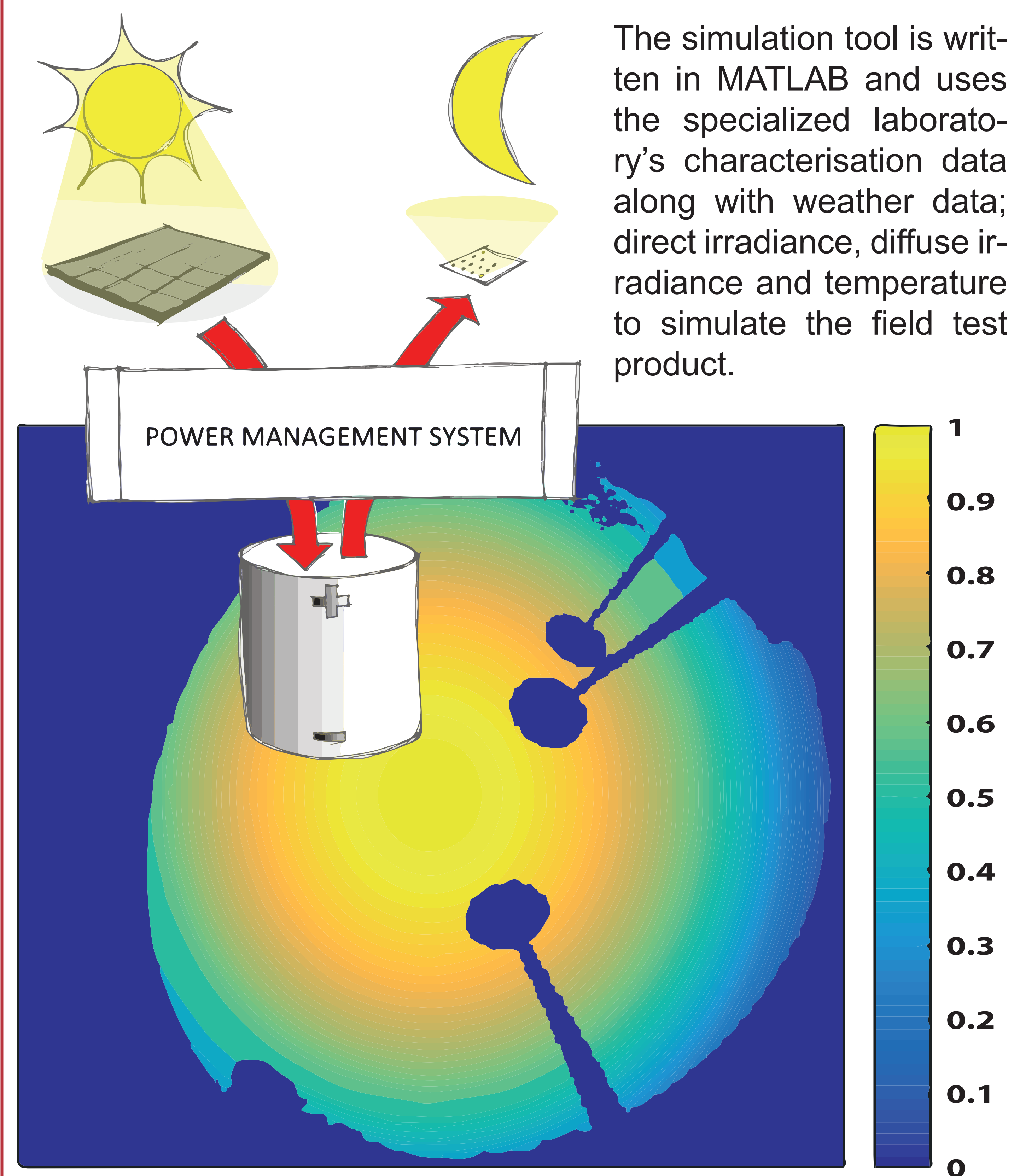
## Conclusion

An urban stand alone PV powered lighting simulation tool was created and validated by a field test product with a cumulated energy difference up to 5.3 % for the different components over a four day time period. Next step is an extended characterization of PV-panel and battery.

## Simulation



Power calculated by the simulation tool. Weather data from weather station at DTU Risø 1 min resolution



With a fraction of open sky at 70 % a level of 81 % of the Diffuse light contributes to the total irradiation.